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7. Performing Organization Name(s) and Address(es) Woods Hole Oceanographic Institution		8. Performing Organization Report Number	
9. Sponsoring/Monitoring Agency Name(s) and Address(es) Dr. Robert Gisiner Office of Naval Research, Biological Sciences and Technology 800 N. Quincy St., Ballston Tower One Arlington, VA 22217-5660		10. Sponsoring/Monitoring Agency Report Number N00014-97-1-1031	
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13. Abstract The objectives of this study were to characterize the responses of whales to experimental playback of low frequency sounds from the SURTASS LFA sound source. The study involved three different field studies: the first phase involved fin and blue whales feeding in the Southern California Bight, the second phase involved gray whales migrating past the California coast and the third phase involved humpback whales singing offshore of the Big Island of Hawaii. Observers on shore and on the source vessel tracked the movement patterns of whale groups with respect to the sound source. Fin and blue whales and singing humpback whales were followed by an observation vessel and tracked acoustically in order to monitor vocal responses to playback. We have presented preliminary results from each phase in several meetings and in quick look reports (the quick look report for phase III is just being completed). The remaining tasks for next year are completing analyses and writing up results for submission to peer reviewed scientific journals.			
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Responses of whales to experimental playback
of low frequency sound from the Navy
SURTASS LFA

2. Objective

Characterize the responses of fin and blue whales feeding in the Southern California Bight, gray whales migrating past the California coast and humpback whales singing offshore of the Big Island of Hawaii to experimental playback of low frequency sounds from the SURTASS LFA sound source.

3. Approach

Observers on shore and on the source vessel tracked the movement patterns of whale groups with respect to the sound source.

Fin and blue whales and singing humpback whales were followed by an observation vessel and tracked acoustically in order to monitor vocal responses to playback.

4. Progress

My lab conducted three playback series in collaboration with Dr. Chris Clark's lab at Cornell University, Marine Acoustics, Inc., and a variety of Navy personnel and contractors. The first and third phases used the SURTASS LFA vessel as a playback source, while the second phase deployed one of the LFA sound sources from a chartered vessel which was moored near the migration corridor. The first phase was completed in September-October 1997 and studied the responses of blue and fin whales feeding in an area west of San Nicolas Island in the southern California Bight region. My lab focused on using an observation vessel to conduct focal follows of fin or blue whales under control conditions and during playbacks. The second phase was completed in January 1998 off Pt. Buchon, CA and studied the responses of migrating gray whales. I was the PI for this phase and have directed the execution and analysis of the experiment. Observation of whale responses was conducted from two shore stations and from the playback vessel. The third phase was conducted between 26 February and 31 March, 1998 and studied the responses of humpback whales, primarily singers, off the Kona coast of the Big Island of Hawaii. My lab again focused on using an observation vessel to follow singing humpback whales, and used a shore station to follow inshore mother-calf pairs and to conduct scans. The LFA team wrote permit applications and secured permits from NMFS for all three phases of research, and phases I and II were approved by the California Coastal Commission. We have presented preliminary results from each phase in several meetings and in quick look reports (the quick look report for phase III is just being completed).

5. significance

These studies will provide important data on the effects of a loud low frequency sound source on the behavior of three species of baleen whales during feeding, migration, and breeding seasons. These data will also be used in the development of an Environmental Impact Statement for the SURTASS LFA system.

6 work plan

All of the data have been collected and preliminary analyses and results have been presented in Quick Look reports for each of the three LFA playback projects. The remaining tasks are completing analyses and writing up results for submission to peer reviewed scientific journals.

7. Technology transfer

These playbacks involved close collaboration with the MILDET on the Cory Chouest, engineers from the Naval Facilities Engineering Service Center, Raytheon, and Marine Acoustics Incorporated.

9 refereed journal articles citing onr support

19980917 073

- in press Burgess, W.C., P.L. Tyack, B.J. LeBoeuf, and D.P. Costa. A programmable acoustic recording tag and first results from free-ranging northern elephant seals. *Deep-Sea Research*
- in press Miller P and P.L. Tyack. A small towed beamforming array to identify vocalizing resident killer whales (*Orcinus orca*) concurrent with focal behavioral observations. *Deep-Sea Research*
- 1997 Tyack, P.L. Development and social functions of signature whistles in bottlenose dolphins, *Tursiops truncatus*. *Bioacoustics* 8:21-46

10 books/chapters citing onr support

- In press J. Mann, R. Connor, Tyack, P.L., and H. Whitehead. *Cetacean Societies: field studies of whales and dolphins*. University of Chicago Press
- in press Tyack, P.L. Communication and Cognition. In: Volume 1, *Biology of Marine Mammals* (J.E. Reynolds III and John R. Twiss Jr. eds), Smithsonian Press, Washington DC.
- 1998 Tyack, P. Acoustic communication under the sea. In: *Acoustic communication in animals: recent technical advances*. (Evans, C.S. and S.L. Hopp, eds.), Springer Verlag, Heidelberg.
- 1997 Tyack, P.L. Studying how cetaceans use sound to explore their environment. *Perspectives in Ethology* 12:251-297
- 1997 Tyack, P.L. and L.S. Sayigh. Vocal learning in cetaceans. In: *Social influences on vocal development*. (Snowdon, C. and M. Hausberger, eds.) pp. 208-233, Cambridge University Press, Cambridge.

11 technical reports and non-refereed papers citing onr support

- Clark CW and Tyack PL (in prep) QUICKLOOK LOW-FREQUENCY SOUND SCIENTIFIC RESEARCH PROGRAM PHASE III: Responses of Humpback Whales to SURTASS LFA off the Kona Coast, Big Island Hawaii 26 February - 31 March, 1998
- Tyack PL and Clark CW (June 1998) QUICK LOOK -- Playback of low frequency sound to gray whales migrating past the central California coast - January, 1998
- Clark CW, PL Tyack and WT Ellison (Jan 1998) Quicklook, phase I, Low frequency sound scientific research program. unpublished report.

12 presentations

- August 1997 LFS SRP Phase II Test Plan meeting, Los Angeles CA
- 29 October 1997 LFA Scientific Working Group Meeting #2, Monterey CA
- 30 October 1997 LFS SRP public outreach meeting. Phase II planning, Monterey CA
- 11 December 1997 LFS SRP Phase II Test Plan meeting, Los Angeles CA
- 13 December 1997 California Coastal Commission hearing, Santa Rosa CA

19-21 January 1998 World Marine Mammal Conference, Monaco

21 April 1998 LFA Executive Board meeting, Washington DC

30 June 1998 LFS SRP public outreach meeting. Phase II results, Crystal City VA



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September 11, 1998

Dr. Robert Gisiner
ONR, Code 341
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Biological Sciences and Technology
800 North Quincy St., Ballston Tower One
Arlington, VA 22217-5660

Dear Dr. Gisiner:

Enclosed are three (3) copies of a progress report and form SF-298 by Dr. Peter L. Tyack for ONR Grant #N000-1497-1-1031.

Copies of the report and form have also been distributed to the other addresses listed in Attachment #1, Reports and Report Distribution.

Sincerely,

A handwritten signature in cursive script that reads "Mary Jane Tucci".

Mary Jane Tucci
Biology Department

xc: Administrative Grants Officer, ONR, Boston (form SF-298 only)
Director, NRL, Washington, DC (1 copy w/SF-298)
✓ DTIC, Ft. Belvoir, VA (2 copies w/SF-298)